1. **Baseline: 5 methods. Include our method**

Robust mixture regression 3.

1. MIXL, MIXT, MIXBI, TLE, CTLERob select one.,
2. Wei Pan, PRclust R package. Paper <https://www.jmlr.org/papers/volume17/15-553/15-553.pdf> github: <https://github.com/ChongWu-Biostat/prclust> Github has two papers’ link.

Spatial constrained mixture regression 2.

1. SCC (JASA journal, github link <https://github.com/changwn/Supplementary-files-for-SCC>). Paper: SCC method in github.
2. ClustGeo (hierarchical clustering with spatial constraint) R package, github link: <https://cran.r-project.org/web/packages/ClustGeo/vignettes/intro_ClustGeo.html>, paper: <https://arxiv.org/pdf/1707.03897.pdf>
3. Spatialcluster (regionalization with dynamically constrained agglomerative clustering and partition) github + paper: <https://github.com/mpadge/spatialcluster>
4. Bug: Spdep (spatial dependence: weighting scheme, statistics) r package: <https://github.com/r-spatial/spdep/>

Image segmentation in computer vision 1.

1. FRGMM (matlab code) <https://sites.google.com/site/nguyen1j/home/10-code>
2. Try to find R/**python** method about image segmentation.
3. Inference tools for Markov Random Fields on lattices: The *R package mrf2d*
4. https://github.com/AliMorty/Markov-Random-Field-Project
5. **Experiments on synthetic data:**

Mixture regression. 5

K : 2,3,4

N: 100, 200, 400

Noise level: sigma (0.05, 0.1, 0.2)

Balance: 40(5),40(5),20; 30(5),50(5),20; 20(5),60(5),20

Coefficient : 3 groups: (1.5,1.0) ; (1.5,0.1) ; (1.5, -1.2)

Outliers for robustness. 2

Regression Outlier: 10%, 20%. 40(5),40(5),20 ; 45(5),45(5),10.

Spatial outlier: 10%, 20%. 40(5),40(5),20; 40(10),40(10),20.

Spatial pattern: 3

Distribution: circle, irregular.

Multivariate normal distribution, multivariate uniform distribution.

Spatial center location: 2 group. Center, (1,1) & (-1,-1) ; (0.5,0) & (-0.5,0)

Density of points: 2 group. Different radius. R=0.1 or 0.5.

Density of points, outliers (error in center, outside center), spatial outliers.

Fig1: 10 group of experiment, each group contains two subgraphs (reg line + spatial coord)

Fig + table: result

1. **Metric:**

Clustering membership.

Rand Index and (ARI)

Outlier detection (fig)

Outlier accuracy rate : A/30

Regression model parameters. (table)

include slope and intercept. R square, goodness of fitting.

Beta=[1.5,1]

Thus, ||Beta||\_2 = sqrt((1.5-beta1)^2 + (1-beta2)^2)=distance score

Beta1 = 1.4, beta2 = 0.9, beta1 > beta2.

1. **Ablation experiment.**
2. Remove spatial information
3. Remove error
4. Remove mixture